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Davidson, Davidson & Kappel, LLC
485 7th Avenue
14th Floor
New York, NY 10018

EXAMINER	
BOYD, ERIN M	

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/583,626
Filing Date: April 10, 2007
Appellant(s): BLAUDIN DE THE, FRANÇOIS

Field Code Changed

John S. Economou
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 5/12/2009 appealing from the Office action mailed 12/10/2008.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

3804710	**Bresnick**	**4-1974**
4046631	**Clapham**	**9-1977**
4120752	**Ocken**	**10-1978**
4111748	**Hayashi et al.**	**9-1978**

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 12 is rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential steps, such omission amounting to a gap between the steps. See MPEP § 2172.01. Some of the omitted steps are: providing all the structure claimed in Claim 6, stacking the fuel pellets in the cladding, etc.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1[1] [sic], 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 3,804,710 (herein after "Bresnick") in view of Applicant's own admission.

5. Regarding Claim [6], Bresnick teaches a fuel rod for a nuclear reactor that is cooled by water, comprising a cylindrical tubular cladding 1; a column of nuclear fuel pellets 2 that are stacked one on top of another inside the tubular cladding 1 in the axial direction of the cladding; a first end plug 6 for tight closure of a first axial end of the cladding of the rod 1 arranged at a lower portion of the fuel rod when the rod is in an operating position inside the nuclear reactor, the cladding of the rod having an axis vertical (figure 1); and a second plug 7 for a tight closure of the second axial end of the cladding, the column of fuel pellets 2 resting on an inner portion of the first plug 6, referred to as a lower plug, via a first lower end, and being retained inside the tubular cladding 1 by a compression spring 5 that is interposed between a second upper axial end 4 of the column of fuel pellets 2 and an end of an inner portion of the second plug 7, referred to as the upper plug, wherein the inner portion of the lower plug 6 engaged

inside the tubular cladding 1 successively comprises, in the axial direction and in a direction from the first towards the second end of the cladding, a first cylindrical portion 13 that has a diameter that is substantially equal to the inner diameter of the tubular cladding, a second cylindrical portion 16 that has a diameter that is smaller than the inner diameter of the tubular cladding and a third cylindrical portion 14 that has a diameter that is smaller than the inner diameter of the tubular cladding and that is greater than the diameter of the second cylindrical portion 16 so that there remains, between a lateral outer surface of the third cylindrical portion 14 and an inner surface of the tubular cladding 1, a radial clearance for passage of gas and a substantially planar end surface 15 on which the first end of the column of fuel pellets 2 rests, so that an annular space for expansion of gas is formed between the outer surface of the second portion 16 of the inner portion of the lower plug 6 and the inner surface of the cladding 1 (figure 1 and 2, column 2, lines 16-60).

Bresnick fails to teach that a volume of the annular space is a function of expansion gas in the fuel rod during operation. However, on page 3, paragraph 2 of the specification Appellant admits that a conventional method of increasing the volume for expansion of the gases in the fuel rod is to provide an upper and lower plenum in the fuel rod (which is what Bresnick does (figure 1)). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to construct the annular space of a fuel rod to have a volume that is a function of the expansion gas in the fuel rod.

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[1] The final office action inadvertently refers to claim 1 instead of claim 6. Claim 1 was previously cancelled and the reference to claim 1 was a typographical error.

6. Regarding Claim 12, the limitation of Claim 12 is a necessary and required step in providing the fuel rod of Claim [6].

7. Regarding Claim 13, Bresnick teaches a fuel rod with annular space and fission gases (column 2, lines 21-24). It is inherent that gases in the fuel rod would fill annular space. Appellant also admits in his specification (page 3, paragraph 2) that a conventional method improves diffusion of the pellet gases towards the lower plenum (i.e. annular space). Furthermore, statements that are either essentially method limitations or statements of intended or desired use (e.g. "...fill the annular space") do not serve to patently distinguish the claimed structure over that of the reference, as long as the structure of the cited references is capable of performing the intended use. See MPEP 2111-2115.

See also MPEP 2114 that states:

> A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647.
>
> Claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danly*, 263 F.2d 844, 847, 120 USPQ 528, 531.
>
> [A]pparatus claims cover what a device is, not what a device does." *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 15 USPQ2d 1525,1528.

As set forth in MPEP 2115, a recitation in a claim to the material or article worked upon does not serve to limit an apparatus claim.

The system in the cited reference is capable of being used in the same manner and for the intended or desired use as the claimed invention. Note that it is sufficient to show that said capability exists, which is the case for the cited references.

8. Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 3,804,710 ("Bresnick"), as applied to Claim 6, in view of U.S Patent No. 4,046,631 (herein after "Clapham").

9. Regarding Claim 7, Bresnick teaches the fuel rod wherein the third cylindrical portion 14 of the inner portion of the lower plug 6 of the fuel rod has a diameter such that there remains, between the outer lateral surface of the third cylindrical portion 14 and the inner surface of the tubular cladding 1, a radial clearance for assembly and passage of gas (figure 1).

Bresnick fails to teach that the radial clearance is between one and two tenths of a millimeter, but Clapham teaches that the radial clearance between a third cylindrical portion 7 and the tubular cladding 1 is 1.8 mm (figure 1, column 3, lines 9-10).

Although neither Bresnick nor Clapham disclose the specific values for the radial clearance claimed in Claim 7, one of ordinary skill in the art is expected to routinely experiment with the parameters, especially when the specifics are not disclosed, so as to ascertain the optimum or workable ranges for a particular use. Accordingly, it would have been obvious through routine experimentation and optimization, for one of ordinary skill in the art to find that one to two tenths of a millimeter is an

appropriate/sufficient radial clearance between the tubular cladding and third cylindrical portion; and hence, design the plug/fuel rod as such.

10. Regarding Claim 8, Bresnick teaches the basic inventive features, but fails to teach that the second cylindrical portion of the inner portion of the lower plug has a diameter of between 40% and 60% of the inner diameter of the tubular cladding and a length in the axial direction of between 8 and 10 times the inner diameter of the tubular cladding.

Clapham teaches that the second cylindrical portion 6 of the inner portion of the lower plug 4 had a diameter of about 18% of the inner diameter of the tubular cladding (column 3, lines 10-11).

Although neither Bresnick nor Clapham disclose the specific percentage that the diameter of the second cylindrical portion 6 is of the diameter of the tubular cladding 1, claimed in Claim 8, one of ordinary skill in the art is expected to routinely experiment with the parameters, especially when the specifics are not disclosed, so as to ascertain the optimum or workable ranges for a particular use. Accordingly, it would have been obvious through routine experimentation and optimization, for one of ordinary skill in the art, to find that designing the second cylindrical portion diameter between 40% and 60% of the diameter of the tubular cladding 1 is sufficient / appropriate. In addition, appellant discloses in the specification (page 13, line 25-33) that the intermediate portion (second cylindrical portion) may have any length in the axial direction which allows the end of the tubular cladding to be closed in a tight manner relative to the fist cylindrical portion and

the fuel pellet column; thus, the limitation that the length of the second cylindrical portion is 8 to 10 times the diameter of the tubular cladding is a matter of design and not critical to the invention.

11. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 3,804,710 ("Bresnick"), as applied to Claim 6, in view of U.S. Patent No. 4,120,752 (herein after "Ocken").

12. Regarding Claim 9, Bresnick teaches the basic inventive features, but fails to teach that at least a portion of the fuel pellets of the column of fuel pellets comprises one of plutonium oxide and a mixed oxide of uranium and plutonium.

Ocken teaches mixed oxide fuel pellets 10 of uranium and plutonium (figure 2; column 2, lines 63-66).

The motivation for using mixed oxide (uranium and plutonium) as fuel in the fuel rod of a reactor is to provide the necessary heat energy for a coolant flowing past the fuel rod, yet the maintaining the structural integrity of said fuel rod (column 2, lines 28-34). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use mixed oxide (plutonium/uranium) fuel pellets as the fuel source in a nuclear reactor.

13. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 3,804,710 ("Bresnick"), as applied to Claim 6, in view of U.S. Patent No. 4,111,748 (herein after "Hayashi et al.").

14. Regarding Claim 10, Bresnick teaches the basic inventive features, but fails to teach that there is at least one cross-member in at least one zone of the second cylindrical portion, extending in an axial direction, the at least one cross-member constituted by a diametrically widened cylindrical portion of the second cylindrical portion that has an outer diameter that is substantially equal to the inner diameter of the tubular cladding that is reduced by an assembly clearance.

Hayashi et al. teaches a lower end plug 5 / supporting structure 3e combination of a nuclear fuel rod that has a cross-member 6e in the zone of the second cylindrical portion 13, extending in the axial direction, the cross-member 6e constituted by a diametrically widened cylindrical portion of the second cylindrical portion 13 that has an outer diameter that is substantially equal to the inner diameter of the tubular cladding 2 that is reduced by an assembly clearance (figure 1 and 7b).

A motivation for designing the end plug as described above is to allow the production of a series of successive breaks to thereby allow retention of relatively uniform distribution of stress in the cladding tube or at the plugged end junctures (column 2, line 64 – column 3, line 3). Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to design the end plug to have at least one cross-member in at least one zone of the second cylindrical portion, extending in an

axial direction and having an outer diameter that is substantially equal to the inner diameter of the tubular cladding that is reduced by an assembly clearance.

15. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 3,804,710 (herein after "Bresnick") in view of U.S. Patent No. 4,120,752 (herein after Ocken).

16. Regarding Claim 11, Bresnick teaches a fuel rod for a nuclear reactor that is cooled by water, comprising a cylindrical tubular cladding 1; a column of nuclear fuel pellets 2 that are stacked one on top of another inside the tubular cladding 1 in the axial direction of the cladding; a first end plug 6 for tight closure of a first axial end of the cladding of the rod 1 arranged at a lower portion of the fuel rod when the rod is in an operating position inside the nuclear reactor, the cladding of the rod having an axis vertical (figure 1); and a second plug 7 for a tight closure of the second axial end of the cladding, the column of fuel pellets 2 resting on an inner portion of the first plug 6, referred to as a lower plug, via a first lower end, and being retained inside the tubular cladding 1 by a compression spring 5 that is interposed between a second upper axial end 4 of the column of fuel pellets 2 and an end of an inner portion of the second plug 7, referred to as the upper plug, wherein the inner portion of the lower plug 6 engaged inside the tubular cladding 1 successively comprises, in the axial direction and in a direction from the first towards the second end of the cladding, a first cylindrical portion 13 that has a diameter that is substantially equal to the inner diameter of the tubular

cladding, a second cylindrical portion 16 that has a diameter that is smaller than the inner diameter of the tubular cladding and a third cylindrical portion 14 that has a diameter that is smaller than the inner diameter of the tubular cladding and that is greater than the diameter of the second cylindrical portion 16 so that there remains, between a lateral outer surface of the third cylindrical portion 14 and an inner surface of the tubular cladding 1, a radial clearance for passage of gas and a substantially planar end surface 15 on which the first end of the column of fuel pellets 2 rests, so that an annular space for expansion of gas is formed between the outer surface of the second portion 16 of the inner portion of the lower plug 6 and the inner surface of the cladding 1 (figure 1 and 2, column 2, lines 16-60).

Bresnick fails to teach that at least a portion of the fuel pellets of the column of fuel pellets comprises one of plutonium oxide and a mixed oxide of uranium and plutonium.

Ocken teaches mixed oxide fuel pellets 10 of uranium and plutonium (figure 2; column 2, lines 63-66). The motivation for using mixed oxide (uranium and plutonium) as fuel in the fuel rod of a reactor is to provide the necessary heat energy for a coolant flowing past the fuel rod, yet the maintaining the structural integrity of said fuel rod (column 2, lines 28-34). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use mixed oxide (plutonium/uranium) fuel pellets as the fuel source in a nuclear reactor.

(10) Response to Argument

Regarding rejection under 35 U.S.C. 112, second paragraph:

Appellant argues that the appropriate basis for this rejection would be 35 U.S.C. 112, first paragraph, rather than under 35 U.S.C. 112, second paragraph because claim 12 does not fail to interrelate essential elements of the claim.

The rejection under 35 U.S.C 112, second paragraph is maintained because Claim 12 does not recite manufacturing the full and complete fuel rod of Claim 6. The fuel rod of Claim 6 comprises cylindrical cladding, nuclear fuel pellets, end plugs, etc. Claim 12 does not recite steps for providing any of the listed components of the fuel rod. Claim 12 also fails to interrelate essential elements of the claim. Providing a tubular cladding, stacking nuclear fuel pellets in the cladding, attaching end plugs to both ends of the cladding, etc. are essential elements/steps to manufacturing the fuel rod of Claim 6. Claim 12 does not recite said elements or any interrelationship between them.

Regarding Claims 6, 12 and 13:

Appellant argues on page 9; paragraph 2, lines 3-8 that Appellant's admitted prior art (herein after “APA”) teaches that is conventional to put a shim on top of the bottom end plug in a fuel rod; thus, the modification of Bresnick in view of APA would be to place a shim on the top of the head portion 14 of the bottom end plug of Bresnick. Examiner disagrees.

In response Examiner argues that the teaching pulled from the admitted prior art is that placing a cross member (shim) on a conventional lower end plug 4, as seen in figures 1A and 1B (also seen in Hayashi et al.; figure 1, reference numeral 5), increases the volume for the expansion of gases inside a MOX fuel rod. The conventional lower end plug does not comprise three cylindrical portions of different diameters as does the modified lower end plug of Bresnick. In other words, the combined three cylindrical portions of different diameters, taught in Bresnick, function as a shim on the lower end plug. This interpretation is entirely reasonable because the lower end plug 6 of Bresnick can function as a (conventional) lower eng plug without the three cylindrical portions due to welding 20 around the peripheral shoulder 12 of the lower end plug (figure 1).

Furthermore, the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See In re Keller, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). One of ordinary skill in the art would have interpreted the lower end plug of Bresnick to function similar to the combined conventional lower end plug and cross-member.

There are no separate arguments for Claims 12 and 13; thus, Examiner should be affirmed on Claims 12 and 13 for the same reasons she should be affirmed on Claim 6.

Regarding Claim 7:

Appellant argues again on page 10; paragraph 4 that one of ordinary skill in the art would not have determined, through routine experimentation, that the radial clearance for assembly and passage of gas between one and two tenth of a millimeter is optimal because one of skill in the art would not have determined that the clearance size would be a result effective variable. Examiner disagrees.

As appellant admits in his specification background (page 3, paragraphs 2 and 4), methods for increasing the volume inside fuel rods for expansion of gases have been explored prior to his invention. One of ordinary skill in the art would realize that increasing the clearance size between the fuel and cladding would increase the volume inside fuel rods for expansion of gases (notice also the clearance taught in Ocken, figure 2). Thus, the result effective variable would be to provide sufficient volume in the fuel rod to facilitate gas expansion (See MPEP §2144.05 (II)). An additional motivation for increasing the clearance size between the fuel cladding would be to provide sufficient space for the gas to pass into the gas expansion section of the fuel rod at an increased rate.

Regarding Claim 8:

Appellant argues on page 11; paragraph 4 that one of ordinary skill in the art would not have determined, through routine experimentation, that the second cylindrical portion of the inner portion of the lower plug having a diameter of between 40% and 60% is optimal because one of skill in the art would not have determined that the proportions of the lower plug diameter and inner diameter of the cladding would be a result effective variable. Examiner disagrees. As appellant admits in his specification background (page 3, paragraph 2), methods for increasing the volume inside fuel rods for expansion of gases have been explored prior to his invention. One of ordinary skill in the art would realize that increasing the volume of the lower plenum would increase the volume inside fuel rods for expansion of gases.

Furthermore, unless the dimensions are critical to the invention, where the general conditions are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation (See MPEP §2144.05 (II)). Appellant admits in his specification on page 13, line 18-21 that "the second intermediate portion" (i.e. second cylindrical portion) “may have any length in the axial direction…which allows the end of the tubular cladding to be closed in a tight manner relative to the fist cylindrical portion and the fuel pellet column…”. Thus, the limitation that the length of the second cylindrical portion is 8 to 10 times the diameter of the tubular cladding is not critical to the invention.

Regarding Claim 9:

Appellant argues on page 12, paragraph 4+ that it would not have been obvious to modify Bresnick in view of Ocken as Bresnick is not designed to have expansion

space of gas capabilities for use with MOX.

The test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See In re Keller, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

Furthermore, it would have been obvious to one of ordinary skill in the art of nuclear fuel rod design at the time of the invention that uranium fuel can be replaced by MOX fuel wherein the motivation for using mixed oxide (uranium and plutonium) as fuel in the fuel rod of a reactor is to provide the necessary heat energy for a coolant flowing past the fuel rod, yet the maintaining the structural integrity of said fuel rod (Ocken; column 2, lines 28-34). Upon replacing the uranium fuel with MOX fuel, one of ordinary skill in the art of nuclear fuel rod design would know that the fuel rod parameters (i.e. expansion space) would need to be modified to be suitable for MOX fuel.

Examiner asserts that it would have been obvious to one of ordinary skill to modify Bresnick in view of Ocken. A motivation for looking to Ocken, a MOX reference, is to benefit from the advantages of MOX fuel as stated above.

Appellant asserts that it is not the fuel rod parameters that need to be adjusted, but the provision of structures internal to the fuel rod that provide an internal annular space for expansion (page 12, paragraph 6). Although Appellant does not list the specific internal structures, Examiner assumes he is referring to the inner portion of the

lower end plug with three cylindrical portions. Examiner asserts that upon replacing uranium fuel with MOX fuel, one of ordinary skill in the art of nuclear fuel rod design would know that the fuel rod parameters, including the lower end plug dimensions, expansion space, etc. would need to be modified to be suitable for MOX fuel.

Regarding Claim 10:

On page 13; paragraph 7, lines 6+ Appellant discloses his confusion regarding Examiner's position stated in the February 25, 2009 Advisory Action. Examiner attempts to clarify her position.

Appellant argues on page 9, paragraph 4 of his response to final office action that cylindrical body 6e is a support for the fuel pellets in the fuel rod which is similar to the third portion in the present invention and not a cross member with the purpose of allowing gas to pass through, prevent scorching of the cladding, and guiding the central part of the plug inside the cladding.

First of all, it is noted that the features upon which appellant relies (i.e., allowing gas to pass through, prevent scorching of the cladding, and guiding the central part of the plug inside the cladding) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Secondly, Claim 10 is drawn to a structural apparatus; thus. a recitation of the intended use ("purpose") of the claimed invention must result in a structural difference

between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. It is clear that the cylindrical body 6e of the prior art structurally serves as a cross member, as described in Claim 10. If the prior art structure is capable of performing the intended use, then it meets the claim. The cross member 6e is capable of being used in the same manner and for the intended or desired use as the claimed invention.

See MPEP 2111-2115.

See also MPEP 2114 that states:

> A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647.
>
> Claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danly*, 263 F.2d 844, 847, 120 USPQ 528, 531.
>
> [A]pparatus claims cover what a device is, not what a device does." *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 15 USPQ2d 1525,1528.

As set forth in MPEP 2115, a recitation in a claim to the material or article worked upon does not serve to limit an apparatus claim.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/E. M. B./

Examiner, Art Unit 3663

/Jack W. Keith/

Supervisory Patent Examiner, Art Unit 3663

Conferees:

Darnell Jayne, APS /dj/

/J. W. K./

Supervisory Patent Examiner, Art Unit 3663